Mandibular Fractures in Iraq: An Epidemiological Study

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Abstract

The purpose of this study was to evaluate the epidemiological characteristics of the mandibular fractures relating to gender, age, the etiology of injury, and the rendered treatment modalities and complications. The data of the patients who sustained mandibular fractures were retrieved and were analyzed retrospectively, and based on these data a descriptive analysis was conducted. A total of 112 patients were included in this study; the most common cause was road traffic accidents (RTAs) followed by assaults and missile injuries. The most frequently involved age group was 11 to 20 years, treatment modalities included conservative, closed reduction and indirect fixation, and open reduction and internal fixation (ORIF) in 11.6, 79.5, and 8.9% of the cases, respectively. Most of the major complications were injury related. This study showed RTAs to be the most frequent cause followed by assaults, it also showed that a high percentage of assault victims were females mainly of low socioeconomic status. Another distinguishing feature in this study was the high incidence of missile injuries in the form of bullets and blasts. Closed reduction still has an important role in the treatment of fractures of mandible especially when the necessary equipments for ORIF are not readily available. A higher complication rate was observed in patients diagnosed with multiple and comminuted fractures as well as those caused by violence in the form of missile and assault injuries.

Keywords
- mandibular
- fractures
- epidemiology

Studies have shown that the incidence of fractures of the mandible ranges from 20 to 59% of all maxillofacial fractures,[1–4] making the mandible the first or the second most commonly fractured bone of the facial skeleton.[3,5] This vulnerability is attributed possibly to its being a mobile bone and therefore has less support than the bones of the middle third of the face and to its exposed position.[5,6] Fractures of the mandible impose a significant impact on the patients leading to functional and esthetic problems as well as emotional or psychological distress, and they are among the most commonly treated injuries in oral and maxillofacial surgery discipline.[4,7,8] The treatment of mandibular fractures is similar in principle to the treatment of fractures of other bones of the body which includes; reduction, fixation, and immobilization with the same goals of restoring esthetic and function.[5,7]

Epidemiological studies of maxillofacial trauma are important as they present information about the patterns and the nature of these injuries in addition to the evaluation of the treatment and the complication rate which can assist the health care providers to deliver better care and to assess and improve the quality of care and prevent or minimize complications.[2,4,7,9]

The purpose of this study was to evaluate the epidemiological characteristics of the mandibular fractures with respect to gender, age, etiology of injury, the rendered treatment modalities, and the complications encountered.

Patients and Methods

This study included patients who sustained mandibular fractures and were treated at the oral and maxillofacial surgery unit at Alyarmook teaching hospital in Baghdad

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during the period extending from May 2010 to September 2011. All the patients were first admitted to the emergency department where the preliminary examination and management of the patency of airway, cervical spine injuries, bleeding, and any neurological deficits were performed. After that, patients were referred to the oral and maxillofacial surgery unit for further evaluation and management, a thorough history was taken from the patients or their escorts, this was followed by clinical examination of the maxillofacial region, radiographic imaging included plain radiographs and/or computed tomographic scans, patients with continuity defects of the mandible were excluded.

After the diagnosis of mandibular fracture was made, through clinical and radiographical examination, treatment was performed, the time lapse between the injury and treatment ranged from the same day of injury to 1 week after injury, the treatment modalities were conservative; consisting of rest and soft diet for about 1 week followed by physiotherapy, this was mainly performed for children, closed reduction and indirect fixation with intermaxillary fixation (IMF) for 4 to 6 weeks and open reduction and internal fixation (ORIF) with either stainless steel wire osteosynthesis or using 2.0 mm miniplates with or without IMF through intraoral or extraoral approaches. All the patients received antibiotics (ampicillin 250 mg/cloxacillin 250 mg IV Acaclox 500 mg (ACAI, Iraq), four times daily or ceftriaxone 1 g IV Novosef (Zentiva, Turkey), two times daily and metronidazole 500 mg/100 mL IV Midagyl (Pioneer, Iraq) three times daily) and analgesics for 7 days postoperatively. Patients were followed up for at least 3 months posttreatment, during this time all the complications were recorded and managed accordingly.

The data of the patients regarding age, gender, etiology, the site, type, and signs and symptoms of mandibular fractures, and the treatment modality were collected and based on these data a descriptive analysis was conducted. This study was exempted from institutional ethical approval because of its retrospective nature.

Results

This retrospective study included a total of 112 patients, 79 (70.5%) of them were males and 33 (29.5%) were females, with a male to female ratio of 2.4:1. The age of the patients ranged from 1 to 85 years with an average of 23.6 years. Overall 25 patients (22.3%) were children younger than 12 years. The age distribution of the patients is shown in ►**Table 1**. The etiologies of mandibular fractures were road traffic accidents (RTAs) in 30 (26.8%) patients (21 males and 9 females), assaults and altercations in 24 (21.4%) patients (16 males and 8 females), missile injuries in 22 (19.6%) patients (19 males and 3 females), falls in 20 (17.8%) patients (11 males and 9 females), industrial or work-related injuries in 5 (4.5%) patients (all males), sport-related injuries in 4 (3.6%) patients (three males and one female), and other causes in 7 (6.2%) patients (four males and three females). It is noteworthy to indicate that the missile injuries resulted from handgun and rifle bullets in 10 patients and bomb blasts in the form of improvised explosive devices, exploding vehicles (car bombs) or explosive vests in the remaining 12 patients.

Table 1 Age distribution of patients

Age (y)	Number	%
0–10	19	16.9
11–20	35	31.3
21–30	31	27.7
31–40	14	12.5
41–50	10	8.9
51–60	2	1.8
61–70		
71–80		
81–90	1	0.9
Total	112	100

A total of 148 fractures were diagnosed; the distribution of the sites of the fractures is summarized in ►**Table 2**. Of the 112 patients, 96 (85.7%) had unilateral fractures, whereas the remaining 16 patients (14.3%) had bilateral fractures. A single fracture was diagnosed in 79 patients (70.5%) whereas 33 patients (29.5%) showed multiple fractures; these were bilateral in 16 patients and unilateral in 17 patients. Of the 112 patients, 97 (86.6%) had simple or compound linear fractures, whereas the remaining 15 patients (13.4%) had comminuted fractures. To note, all the comminuted fractures were caused by missile injuries.

On clinical examination, pain, swelling, and limitation of the mouth opening were present in almost all the patients, malocclusion was evident in 71 patients (63.4%), 25 patients (22.3%) reported numbness in the lower lip region indicating inferior alveolar nerve injury. The concomitant injuries included; facial wounds and lacerations in 45 patients, 5 patients exhibited facial nerve weakness; middle third fractures in 3 patients; and 2 patients had lower limb fractures.

Treatment was conservative in 13 patients (11.6%), closed reduction and indirect fixation in 89 patients (79.5%), and ORIF in 10 patients (8.9%).

Table 2 Distribution of the sites of mandibular fractures

Site of the fracture	Number	%
Angle	41	27.7
Parasymphysis	35	23.6
Condyle	25	16.9
Body	23	15.5
Alveolus	14	9.5
Symphysis	7	4.7
Coronoid	2	1.4
Ramus	1	0.7
Total	148	100

The most frequent complication encountered during the follow-up period was limitation of mouth opening that developed after the release of IMF, this was managed by physiotherapy and all the patients regained their normal mouth opening ($\geq$ 35 mm) within 2 weeks to 1 month after the IMF. Three patients (2.8%) had postoperative infections (all of them sustained mandibular fracture caused by missile injury), two of them were treated by closed reduction and one by ORIF. One patient (0.9%) who had sustained displaced fracture body of the mandible showed delayed union after 6 weeks of IMF, this was managed by another 3 weeks of IMF. Three patients (2.8%) developed salivary fistulae of the parotid glands, those patients sustained missile injuries with facial wounds in the parotid region, and the fistulae were treated conservatively by pressure application. Of the five patients (4.5%) who had facial nerve weakness, three patients regained the normal function and two showed persistent weakness after 6 months of treatment. Of the 25 patients (22.3%) with inferior alveolar nerve injuries, 23 of them showed recovery in a period ranging from 10 days to 5 months postinjury, whereas 2 patients did not recover normal sensory function after 6 months postoperatively.

Discussion

The results of this study are in line with other studies in that maxillofacial injuries and mandibular fractures are more common in males than in females, with reported male to female ratios ranging from 3:1 to 5.4:1.[1–8] This study also shows that the highest prevalence of mandibular fractures occurred in patients in the second decade followed by the third decade, other studies found the highest prevalence of mandibular fractures to be in the third decade, while patients younger than 20 years were the second most commonly affected,[2,3,7,10] one study made the observation that among males, the highest prevalence of fractures occurred in the third decade, whereas among females significantly more mandibular fractures occurred after the age of 40 years.[4]

The etiologies of the mandibular fractures were varied; the most common cause, in this study, was RTAs (26.8%). Previous studies from different parts of the world, [1,3,4,10–14] reported RTAs, also termed motor vehicle accidents, to be the primary cause of mandibular fractures. Applying stricter regulations with respect to the use of the safety devices such as wearing seat belts and helmets for motorcyclists in addition to allowing only licensed people to use their vehicles can assist in reducing this high prevalence of RTAs.

Assault is the most commonly reported cause of mandibular fractures,[2,5,15–17] but in this study it came in the second place (21.4%). To note, 8 of the 24 patients (33.3%), who sustained mandibular fractures caused by assaults, were females. Studies have shown lower incidence of female assaults; one study [2] showed that only 7 of a total of 131 patients who sustained mandibular fractures caused by assaults were females making a percentage of 5.3%, in another study 6 of 59 patients (10.1%) of assault group were females. [4] Violence against females is common in the Iraqi society especially among people of low socioeconomic status, a finding that is demonstrated in this study, tackling this sensitive issue requires an increased awareness of the problem in a society where the majority of people considers it as a private issue. A link between facial and mandibular fractures, mainly those caused by RTAs and assaults, and alcohol and narcotics abuses has been established, [2,3] but this relationship could not be verified in the present study mainly because of the underreporting by the hospital staff and the denial of most of the patients as a result of the social and religious restrictions imposed on the consumption as well as the sale of alcohol and the regulations that control the use of narcotics.

In this study, mandibular fractures caused by missile or gunshot injuries occurred in 19.6% of the patients with male predominance (86.4%), gunshot wounds were reported in 5.7% of the causes of mandibular fractures in Nigeria also with male predominance.[4] Missile, or gunshot, injury is not a frequently reported cause of fractures of mandible, [3] Scolozzi and Richter[18] state in their study that "Gunshot injury is an extremely rare cause of mandibular injury in our country." The incidence of missile injuries in Iraq has significantly increased since 2003, most of them are the result of the acts of terrorism and the armed conflict. [19–21] Ballistic high energy transfer trauma to the mandible results in complex and comminuted fractures with varied soft tissue injuries, due to the cavitation and stress wave effects which depend mainly on the velocity of the missile, the missile's presenting area, and the density of the affected tissue,[5,19,22] blasts have different mechanisms to produce tissue damage, of which, fragments are the most common cause of injury and mortality,[23] all the comminuted fractures of mandible that were encountered in this study (13.4%) were caused by missile injuries.

In this study, the angle of the mandible was the most common site involved in mandibular fractures, followed by the parasymphyseal region, condyle, and the body of the mandible. The condyle and the body of the mandible have been reported to be the most common sites, whereas the angle of the mandible was reported to be the second most common site in other studies.[3,4,6,24]

In this study, surgical treatment was performed in 99 patients (88.4%), whereas in the remaining 13 patients (11.6%) treatment was conservative. The majority of patients received closed reduction and indirect fixation (79.5%) whereas only 10 patients (8.9%) received ORIF in the form of wire or miniplate osteosynthesis, this is mainly attributed to the limited resources in the hospital where this study was conducted. All the 13 patients who were managed conservatively were children younger than 12 years. Comminuted fractures of mandible were treated with closed reduction whenever possible to reduce further trauma and preserve blood supply to the fractured fragments. The main indications for closed reduction and ORIF in treatment of comminuted fractures of mandible have been set forth,[25] among the indications of closed reduction was the lack of the necessary equipments for ORIF. In their study, from Nigeria[4] the authors reported that 83.1% of their cases were treated by closed reduction, 3.8% were treated conservatively and 13.1% received ORIF, and they stated that their treatment options are

based on affordability and availability of miniplates among other clinical considerations. Other studies[2,6] reported that ORIF was provided for 49% of the patients whereas approximately 50% of the patients were treated conservatively or by closed reduction. ORIF with miniplate osteosynthesis is currently considered to be the mainstay in treatment of maxillofacial injuries including mandibular fractures,[4,5] but many studies still find an important role for the closed reduction in the treatment of mandibular fractures.[4,25–27]

Apart from the limitation of mouth opening after IMF, most of the major complications were injury related and were recorded in 25 patients (22.3%), lower complication rates were observed in other studies ranging from approximately 5 to 10%.[2,5,6] No complications were recorded during the follow-up period of the conservatively managed patients. Inferior alveolar nerve damage was observed in all the 25 patients (22.3%), a nearly similar result was observed in another study which reported inferior alveolar nerve injury in 23%.[3] No injury to the inferior alveolar nerve was reported to occur as a result of treatment whether by closed reduction or ORIF. Higher incidence rate of inferior alveolar nerve injury was reported after ORIF of fractured mandible.[28] Of the 25 patients, 5 patients (4.5%) showed facial nerve injury and 3 (2.8%) of them had salivary fistulae also as they all sustained missile injuries that involved the parotid region. Salivary fistulae were reported in 1% of patients with mandibular fractures.[3] Three patients (2.8%) developed infection that required hospitalization, all the three patients sustained comminuted fractures caused by missile injuries, two of them were treated by closed reduction and one was treated by ORIF with wire osteosynthesis. A postoperative infection rate of 2.7% was reported in one study,[2] whereas a higher infection rate (8%) was recorded in another study, and it made observation that 40% were violence cases.[3]

On cross-checking the data of the 25 patients who manifested complications; 11 of them (44%) had missile injuries, 6 (24%) had RTAs, in 4 (16%) patients the causes were assaults, in 2 patients (8%) the causes were falls whereas in the remaining 2 patients (8%) the causes were industrial injuries. The patterns of fractures were linear in 15 patients and comminuted in 10 patients making the percentage of linear (simple or compound) fractures that showed complications to be 15.5% (15 of 97 patients), whereas the percentage of comminuted fractures that showed complications was 66.7% (10 of 15 patients). Also, the data showed that 12 of the 25 patients who developed complications were diagnosed with multiple fractures whereas the remaining 13 patients had single fractures making a percentage of complications 36.4% (12 of 33 patients) for multiple fractures and 16.4% (13 of 79 patients) for single fractures.

In conclusion, despite the limitations of this study, being conducted in a single institute, with relatively small sample number and short period of time, but it reveals, to a certain degree, the general trends of distribution of mandibular fractures in Iraq in terms of age, gender, and causes, and the modalities of treatment provided. This study showed that RTAs to be the most frequent cause followed by assaults, it also showed that a high percentage of assault victims were females mainly of low socioeconomic status. Another distinguishing feature in this study was the high incidence of missile injuries in the form of bullet and blast injuries. Closed reduction still has a role in the treatment of fractures of mandible especially when the necessary equipments for ORIF are not readily available. Complication rate was higher in patients diagnosed with multiple and comminuted fractures as well as those caused by violence in the form of missile and assault injuries.

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